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A63B 53/04

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(54) **Iron golf club head**

(57) An "iron" golf club head comprises a cavity 80 that is open rearwardly and which is bounded by a peripheral edge 810c and an attached weighting insert 810 which is made of material having a greater density than the remainder of the club head and which occupies at least part of the lower portion of the peripheral edge. The insert can be attached by means of screws to provide a compression stress on the insert, by adhesive, by a dove-tail joint, or by pins. The combination of titanium alloy head and the attached weights provides for great flexibility in the provision of club heads with desired characteristics.

Fig:8a

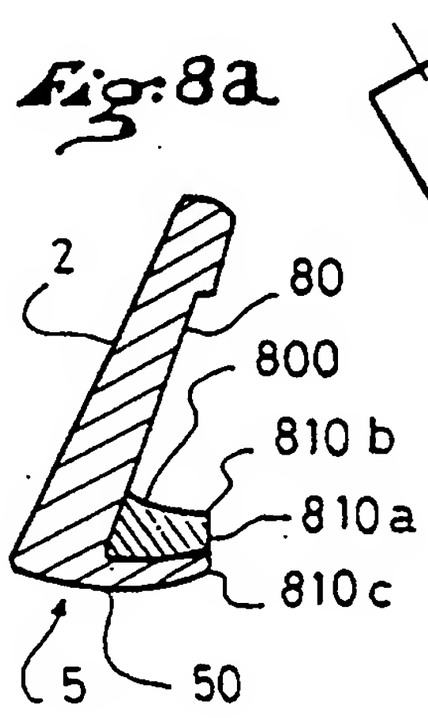

Fig:8

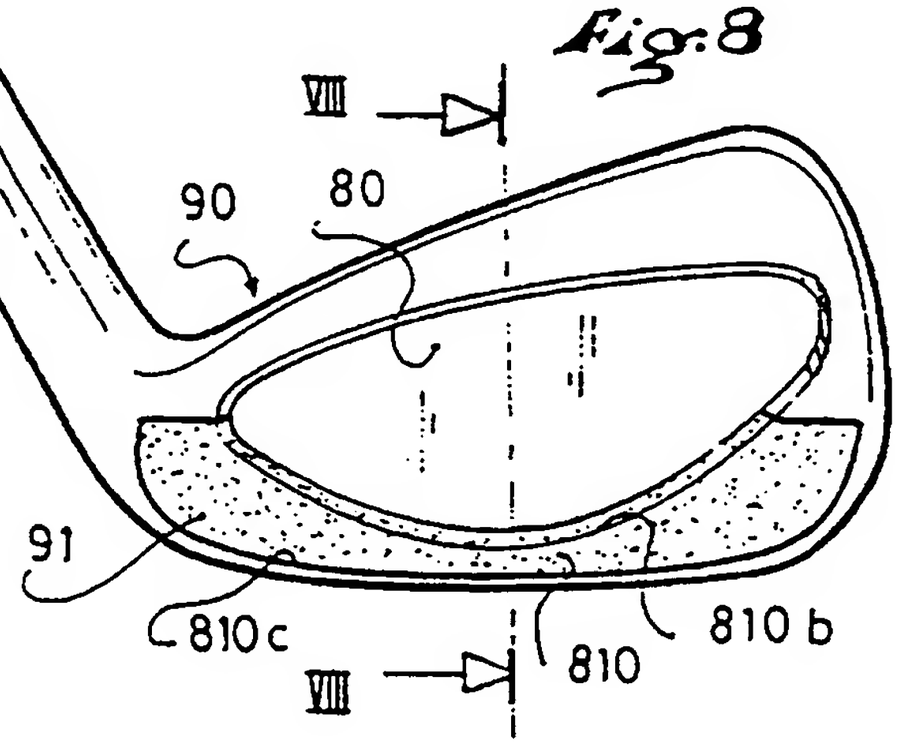

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Fig: 1

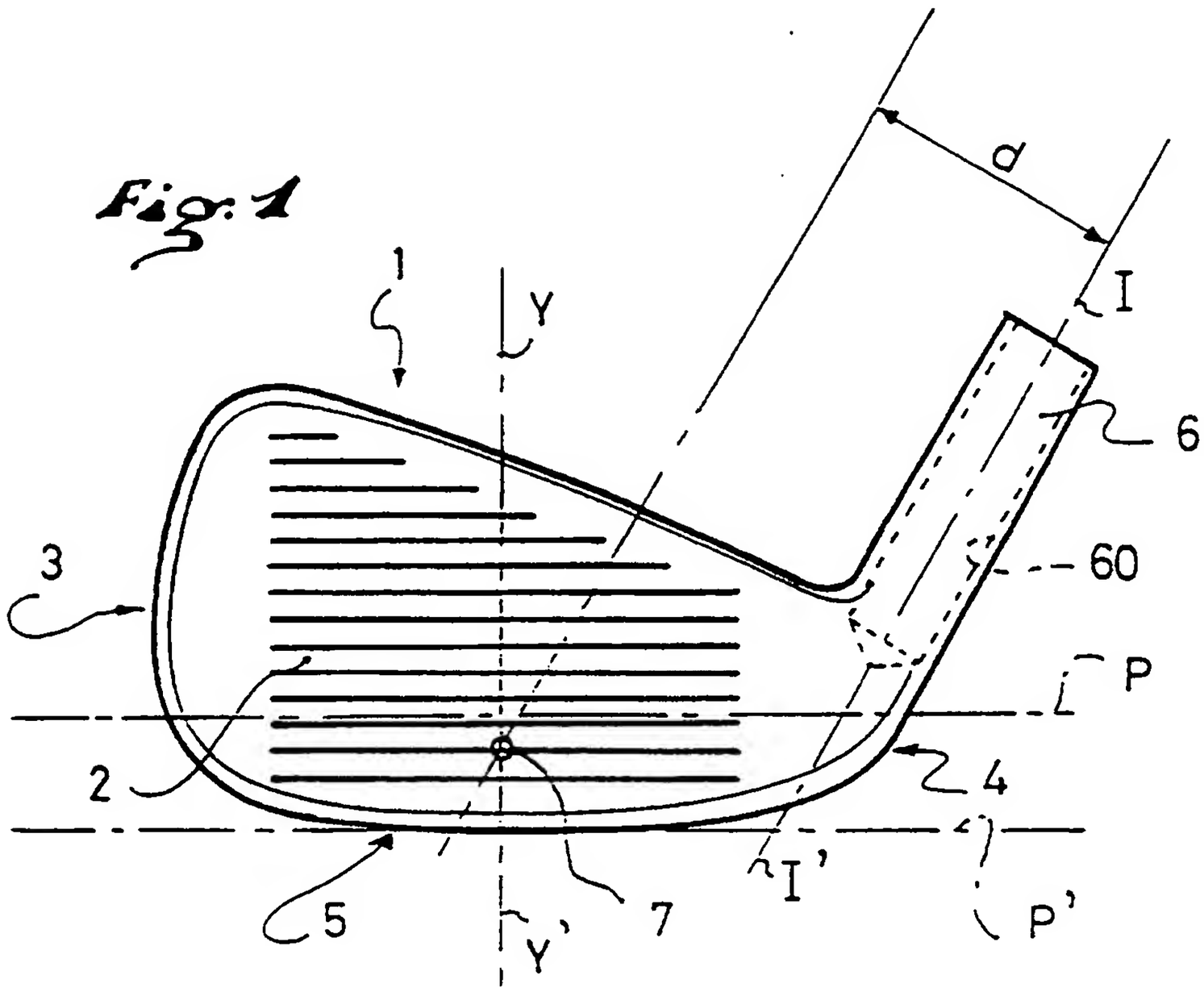
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Fig: 2

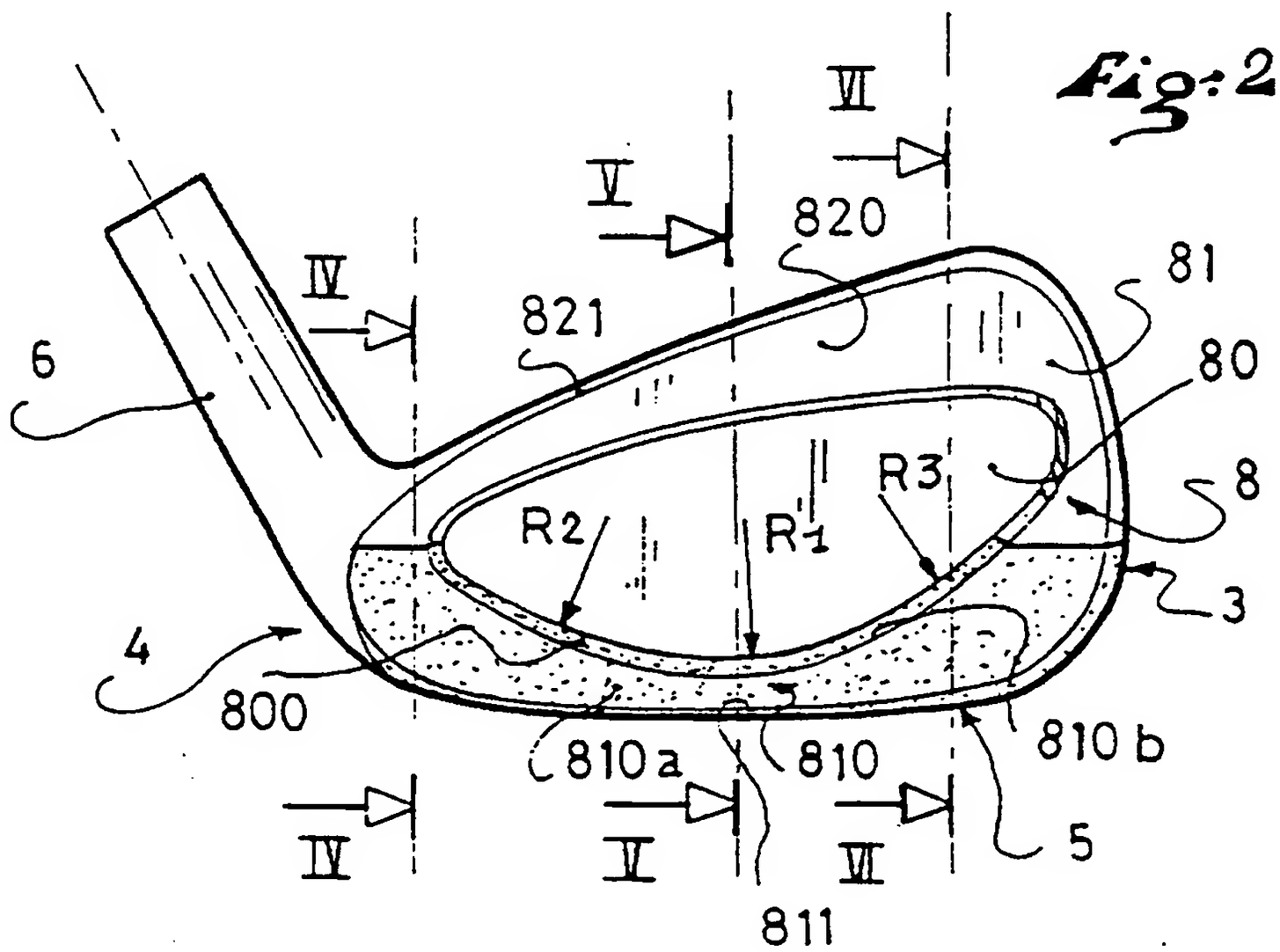
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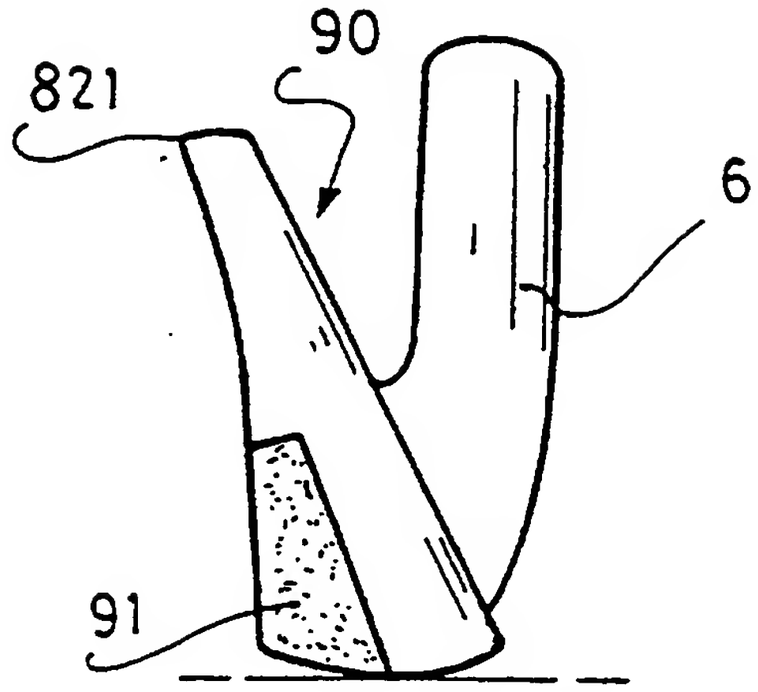
Fig: 3



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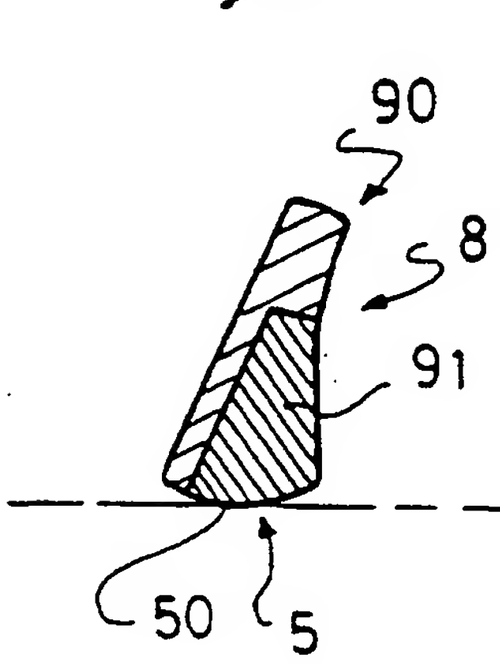

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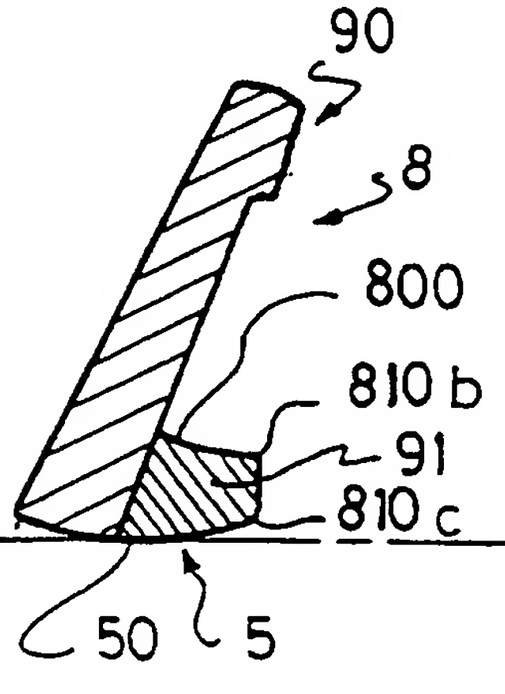

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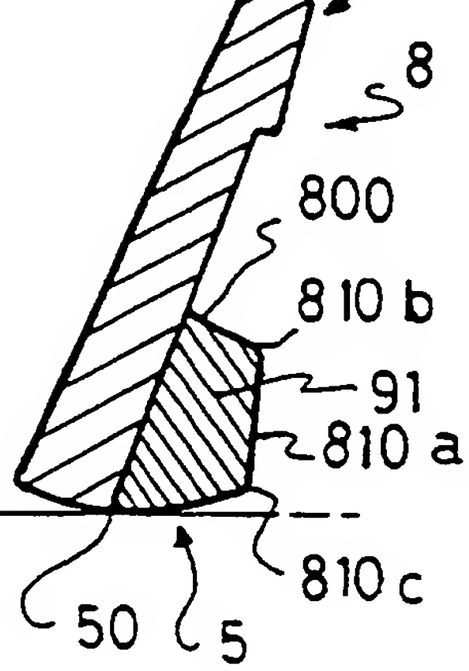
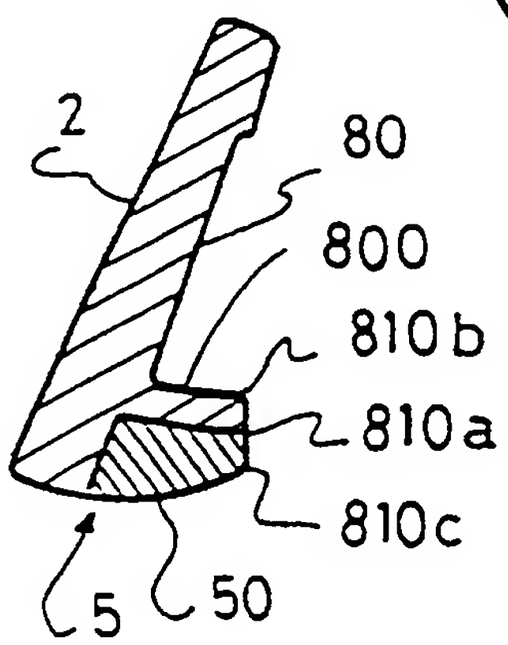


Fig:7a



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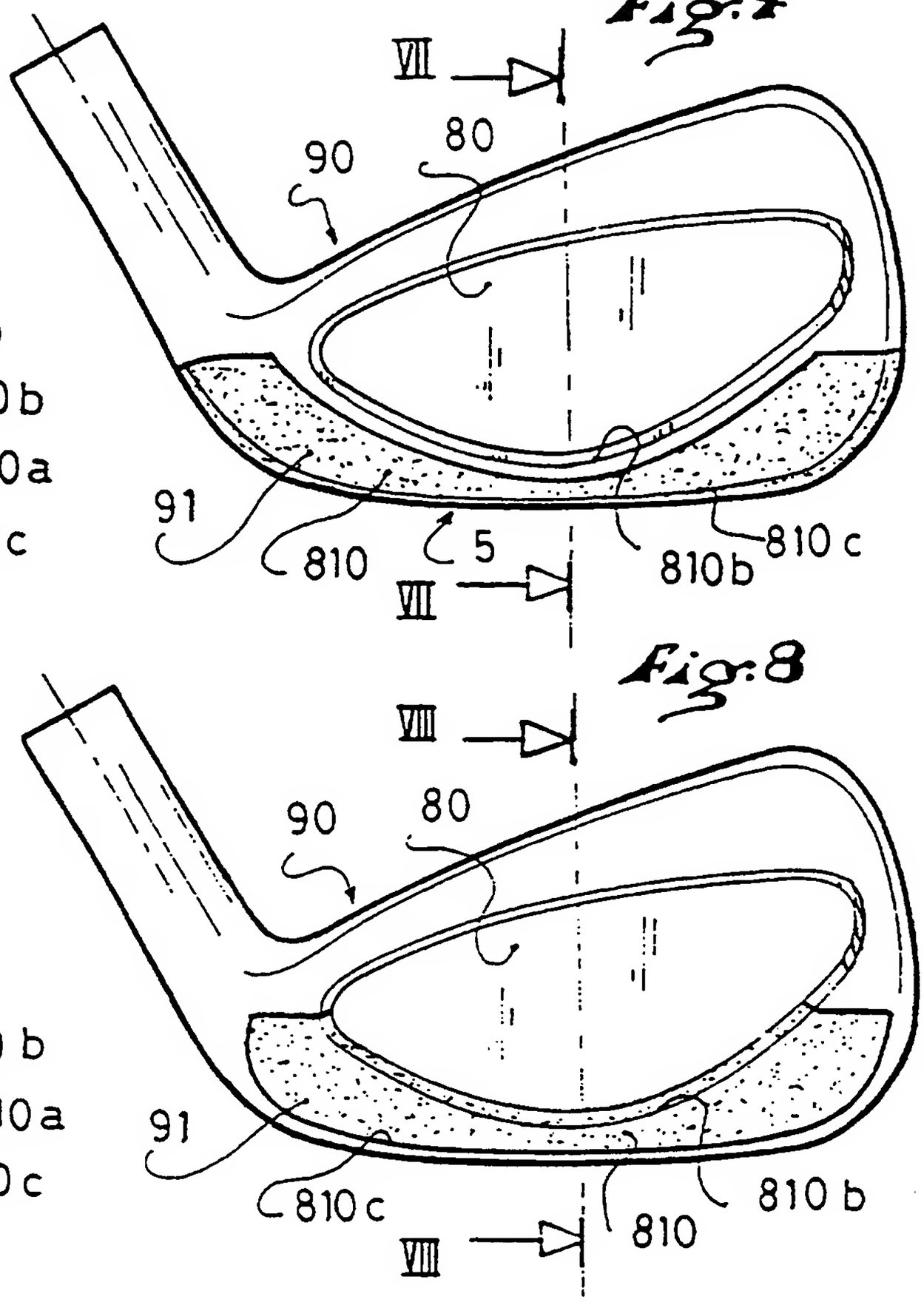


Fig:8a

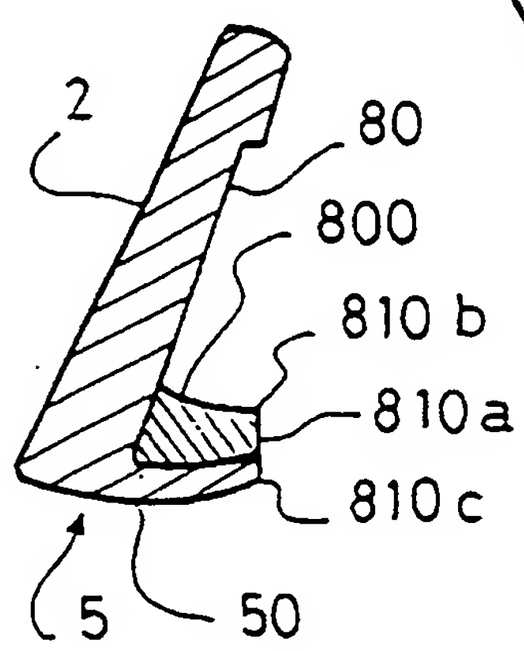
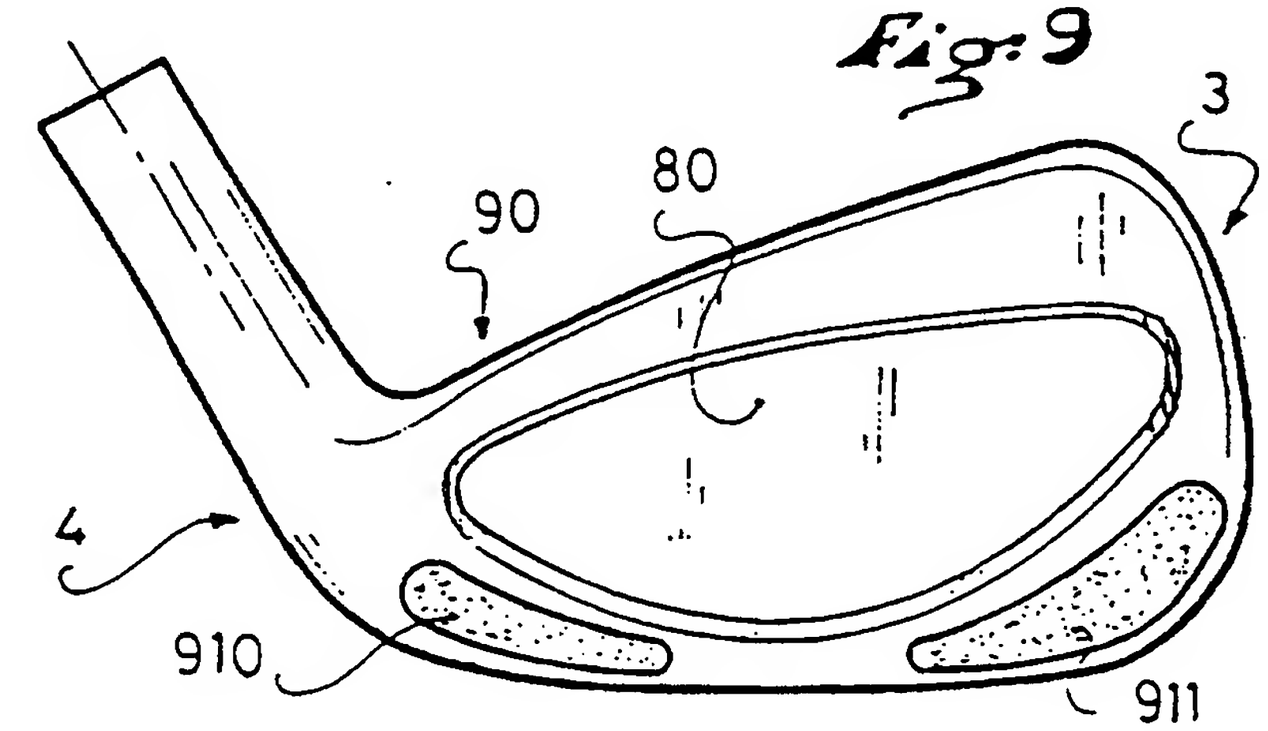


Fig:8

Fig:9



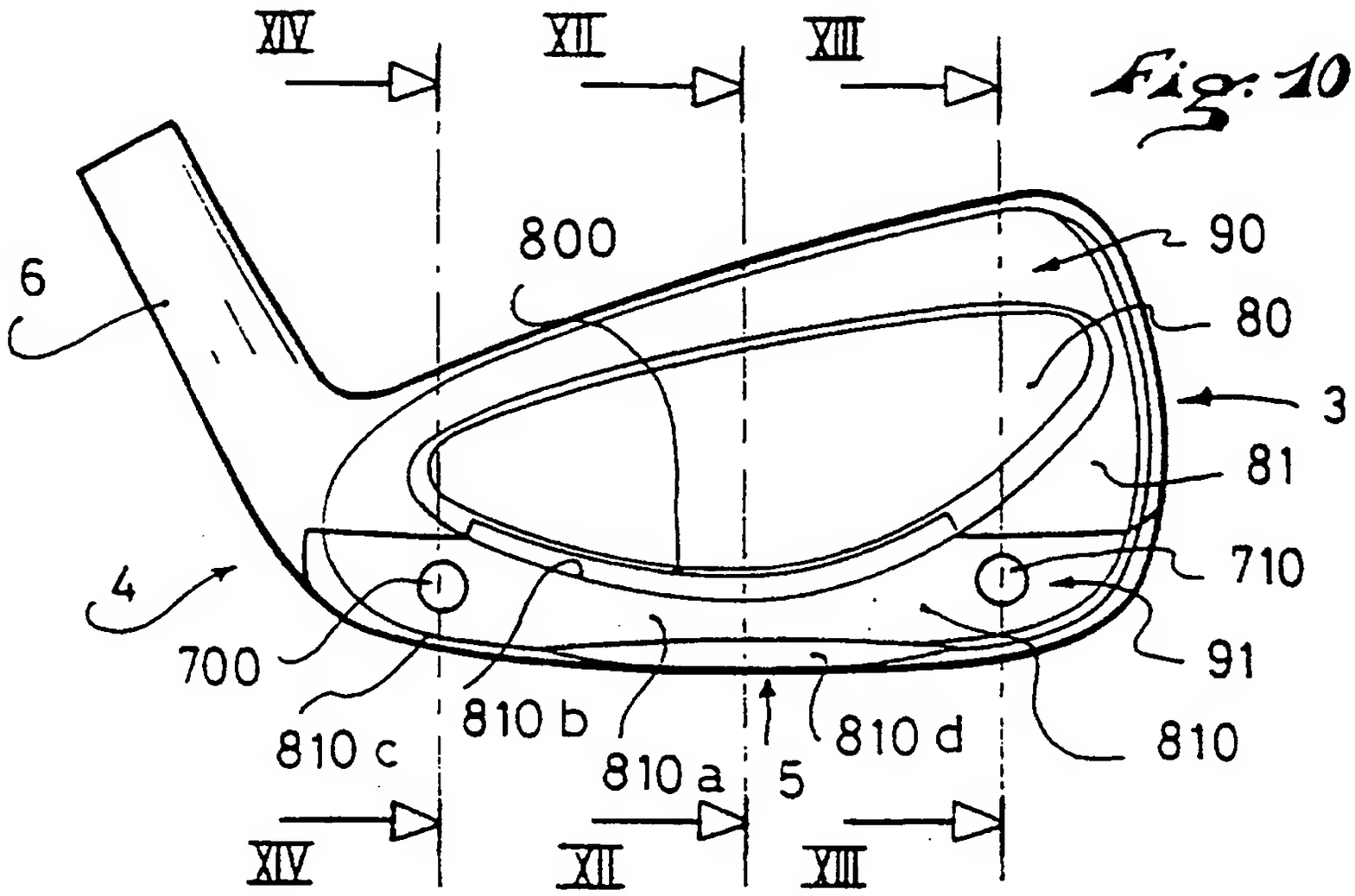

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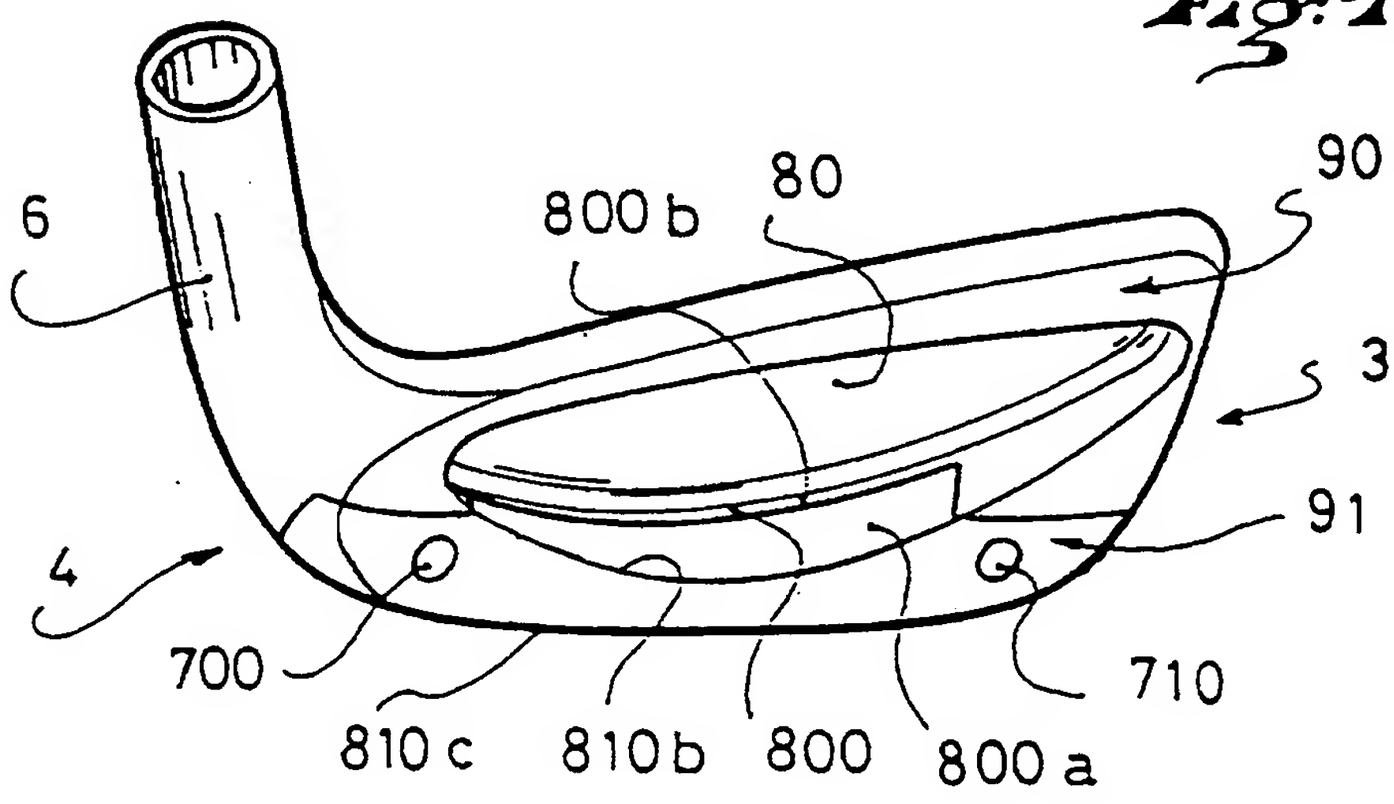
Fig: 10

Fig: 11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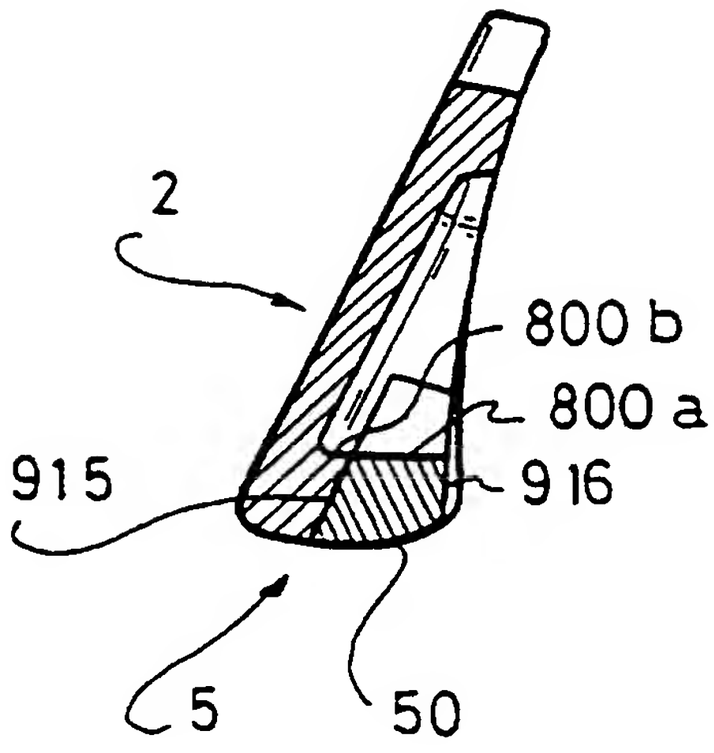

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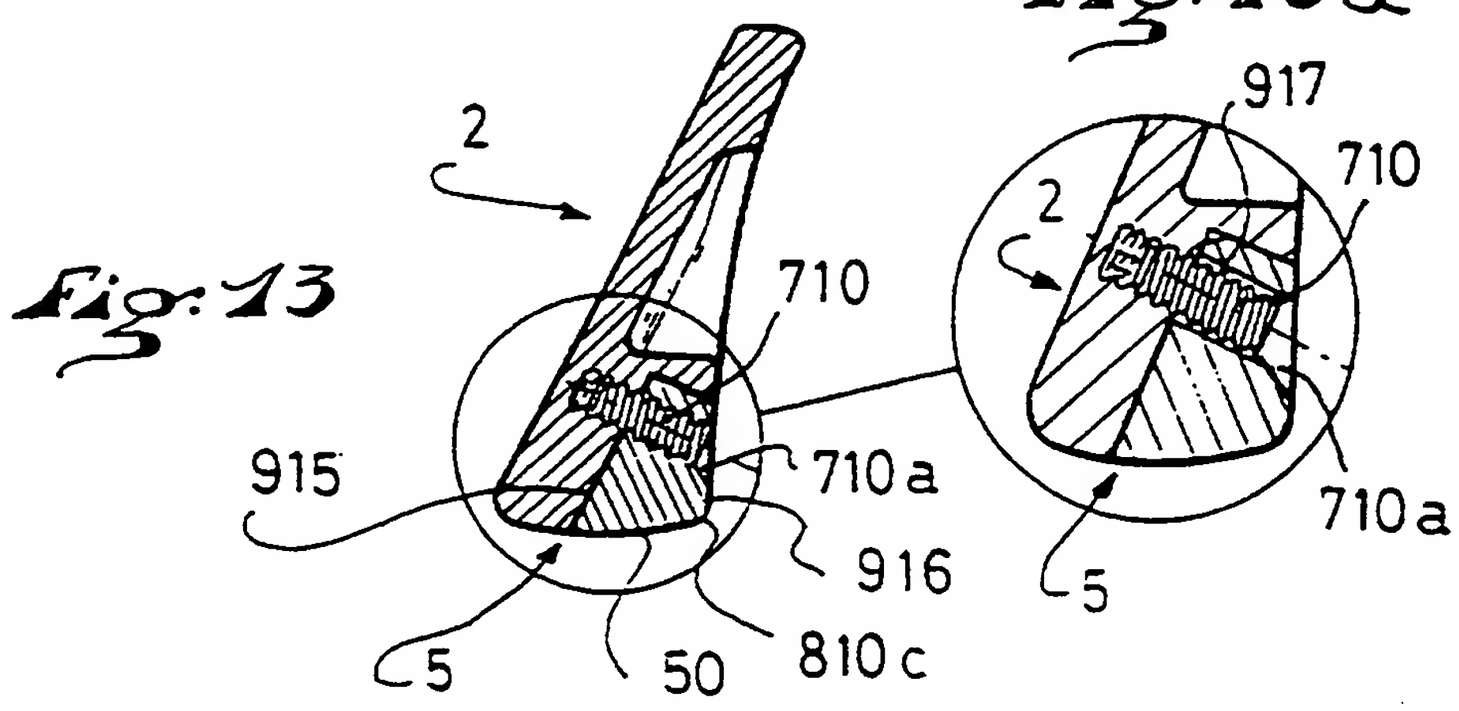
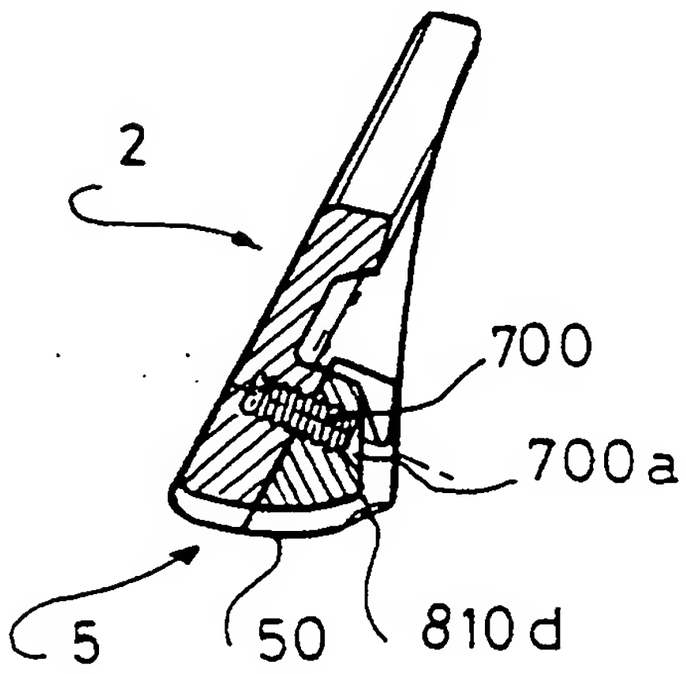


Fig: 13

Fig: 13a



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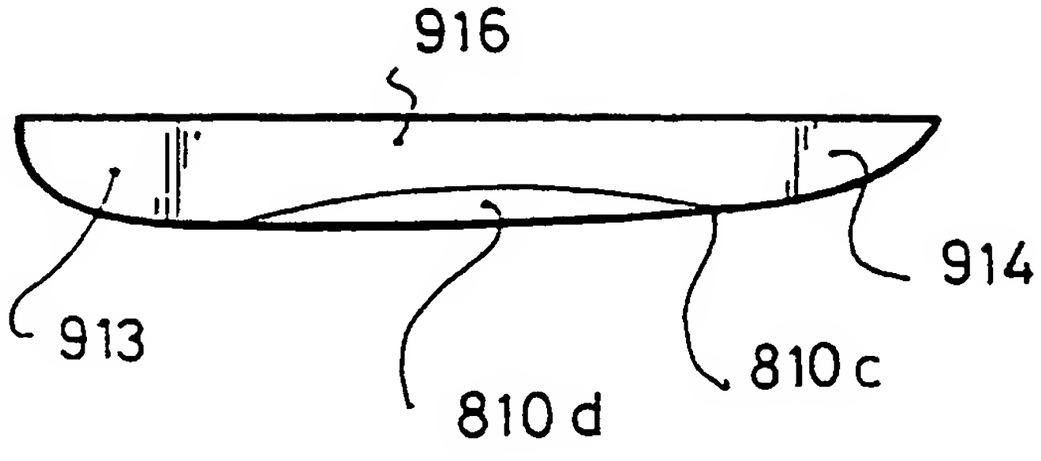

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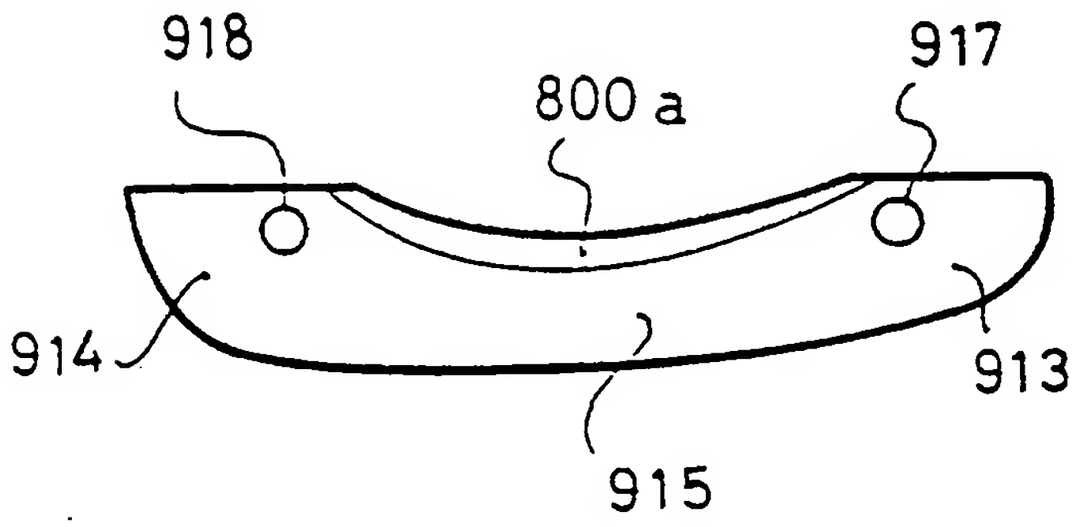

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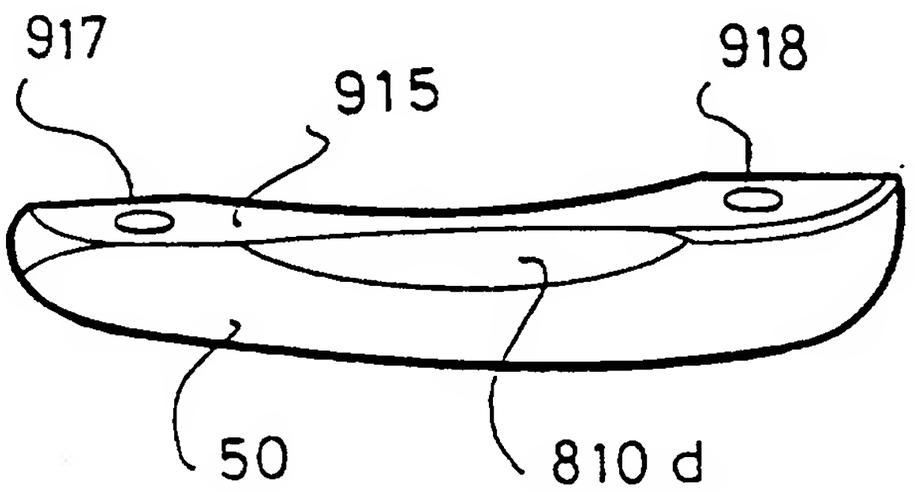

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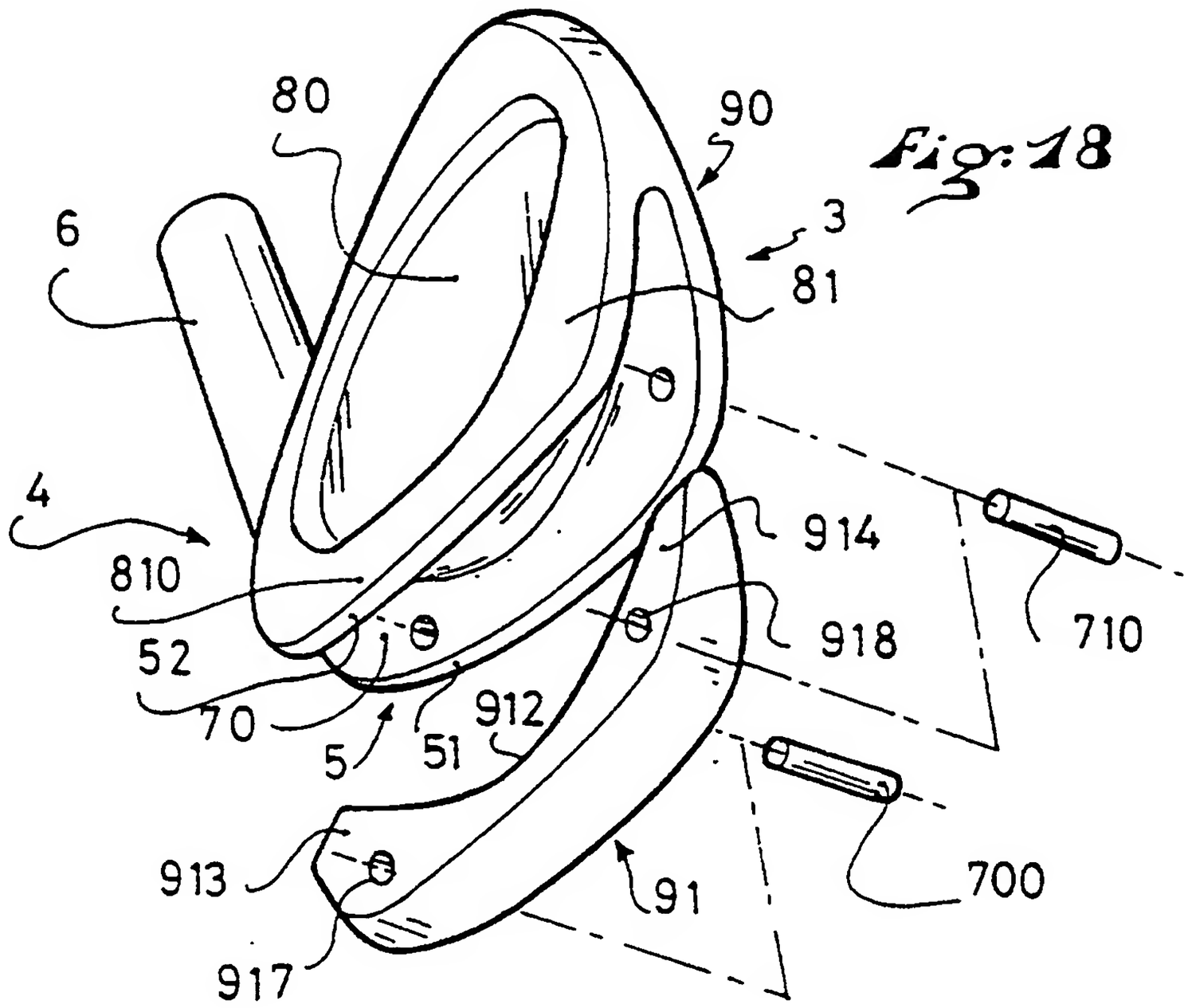
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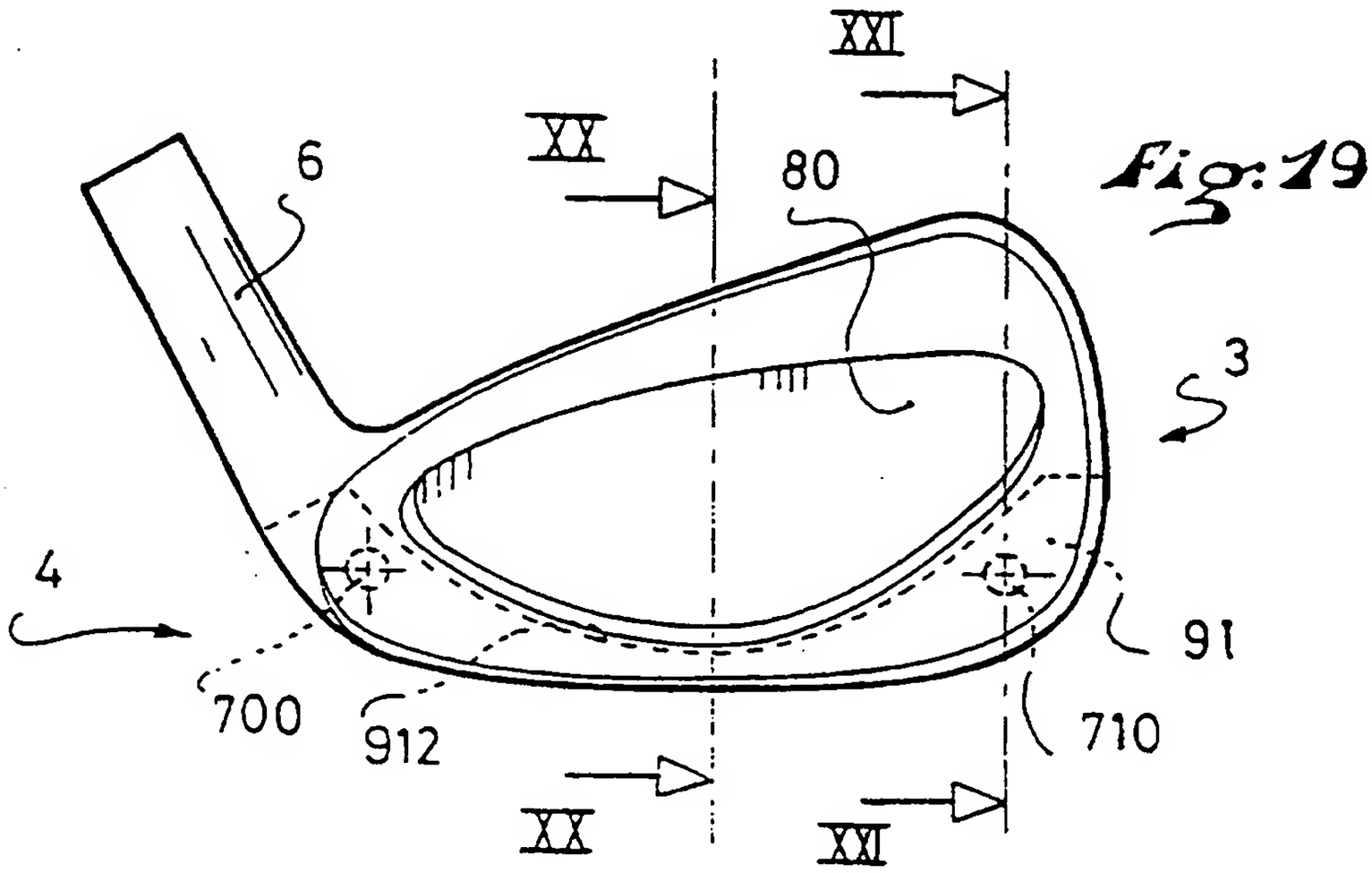
Fig: 18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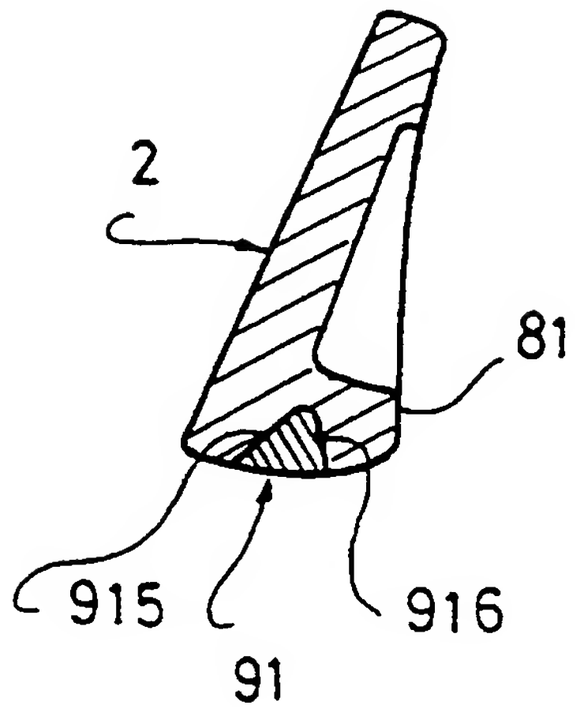

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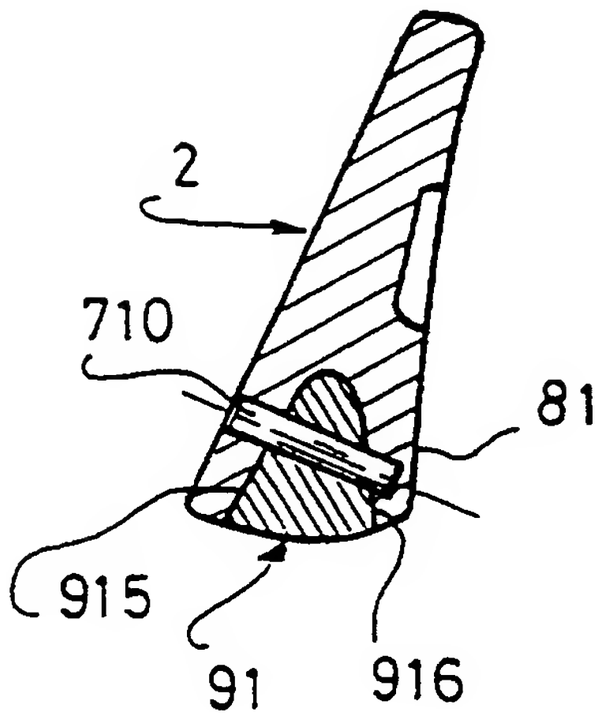

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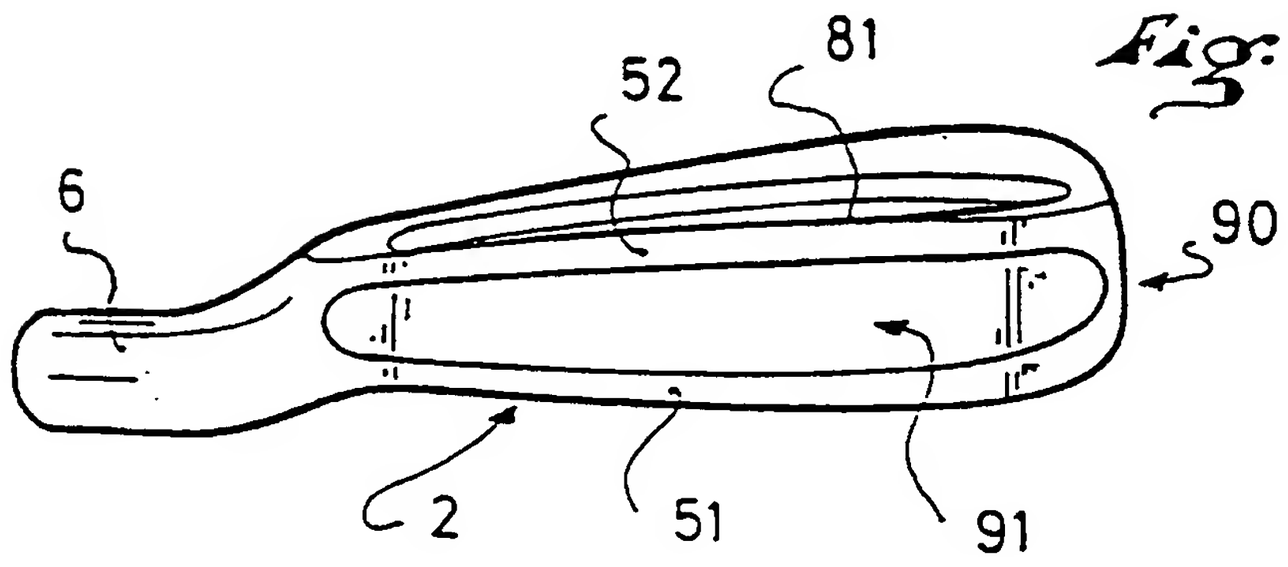

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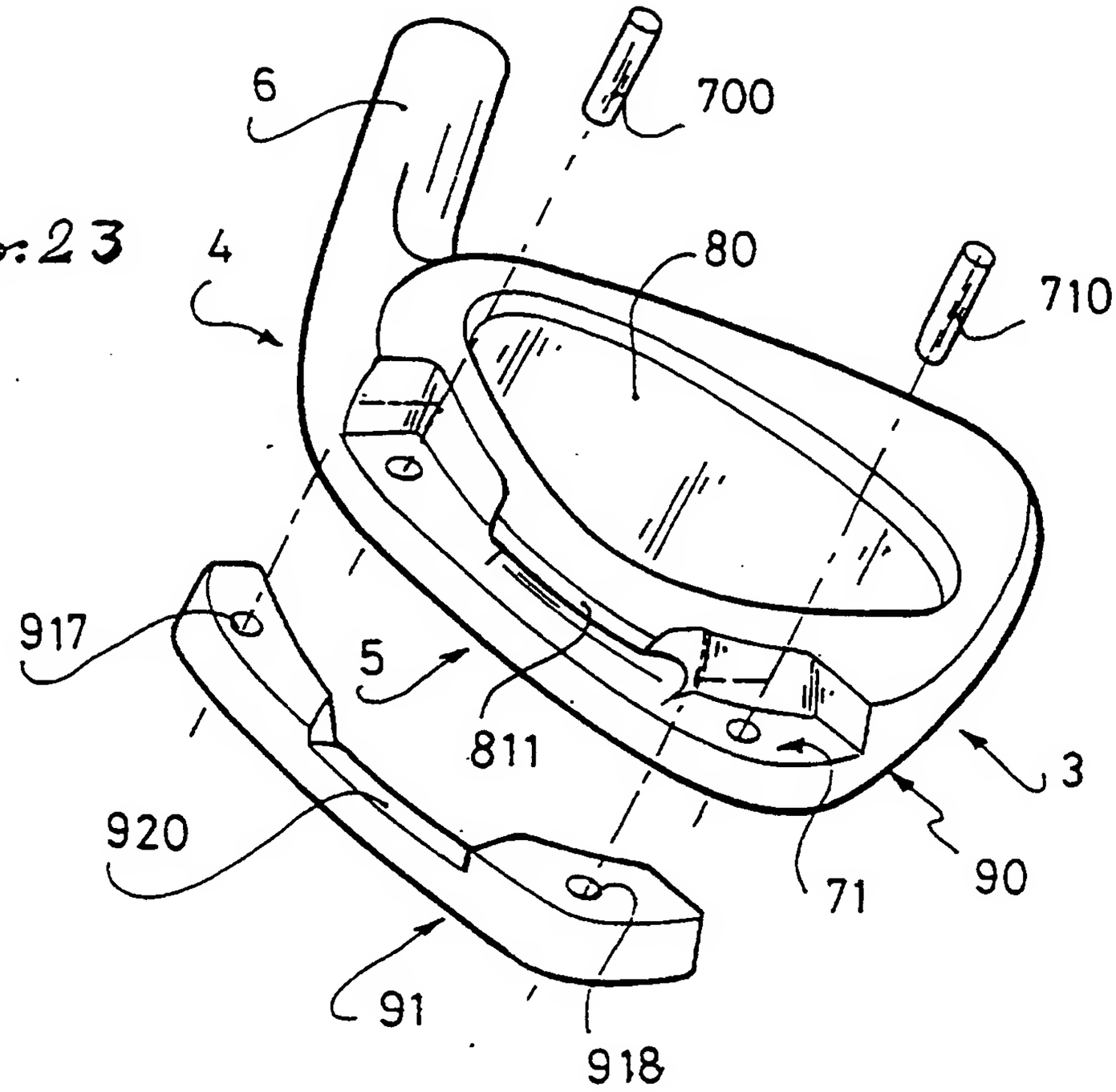

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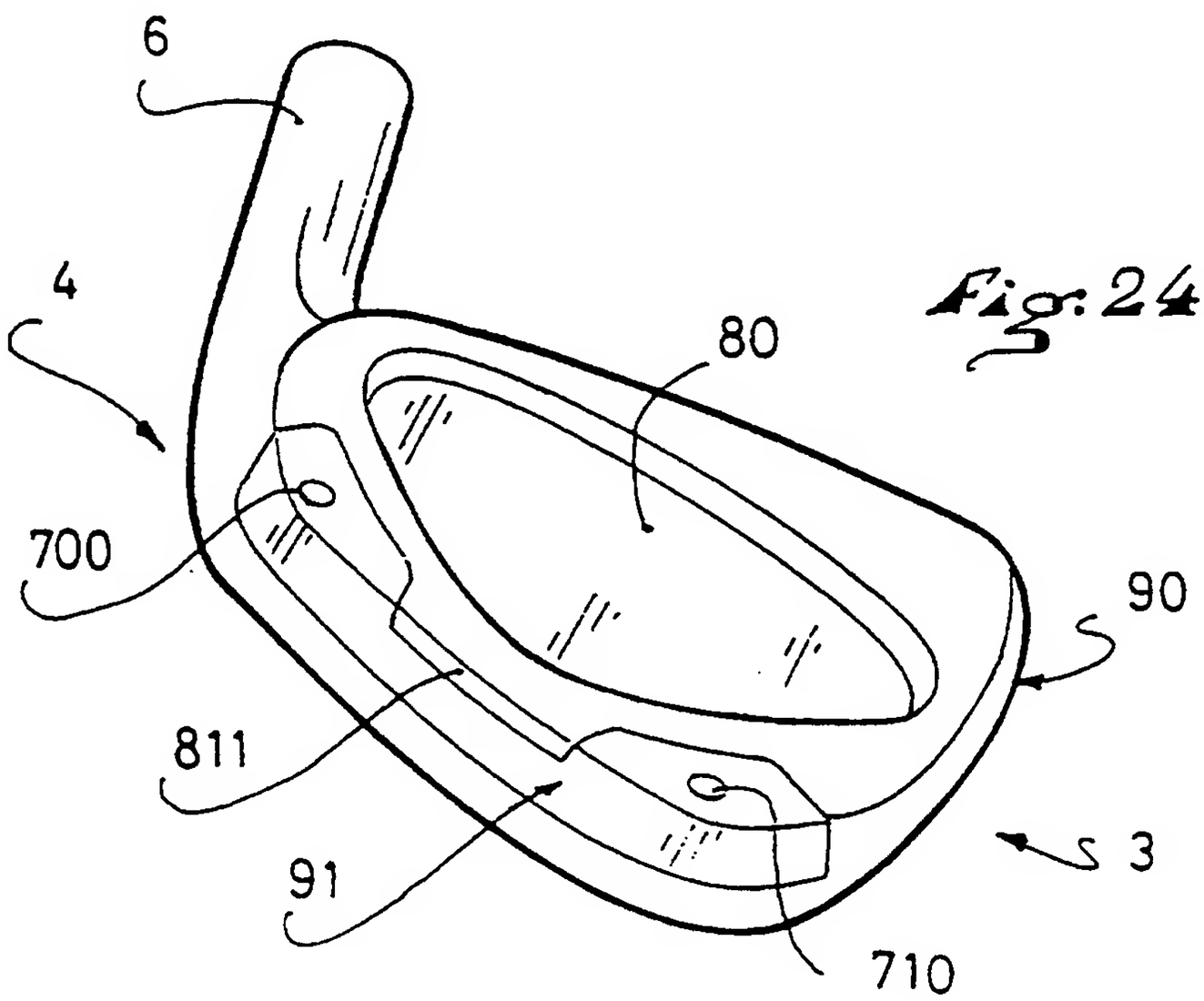


Fig: 24

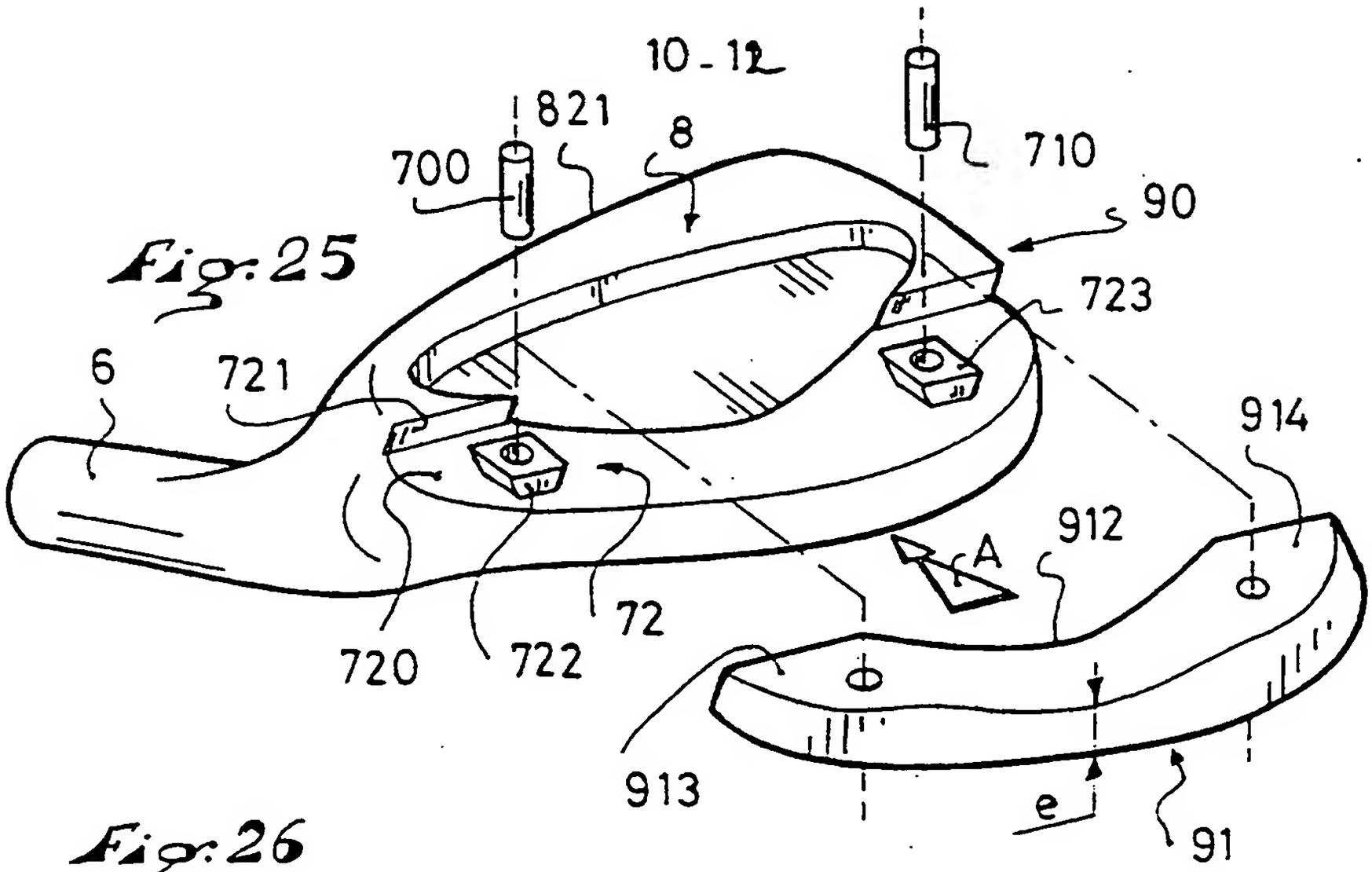
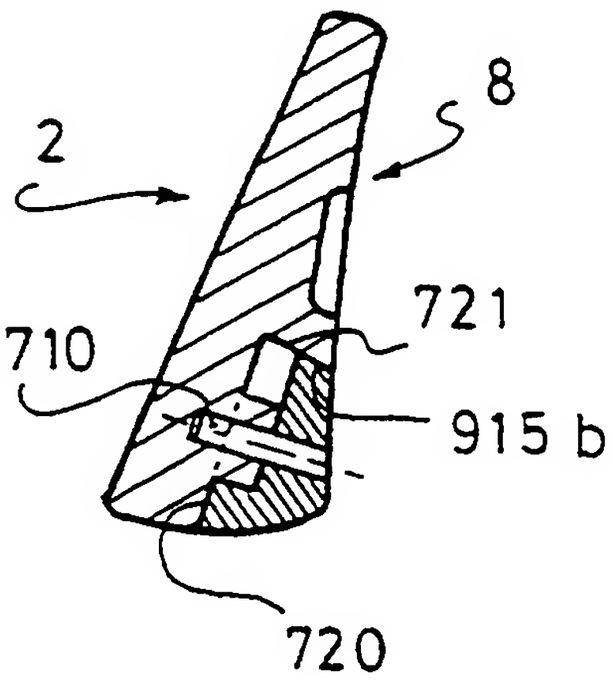


Fig:25

Fig:26



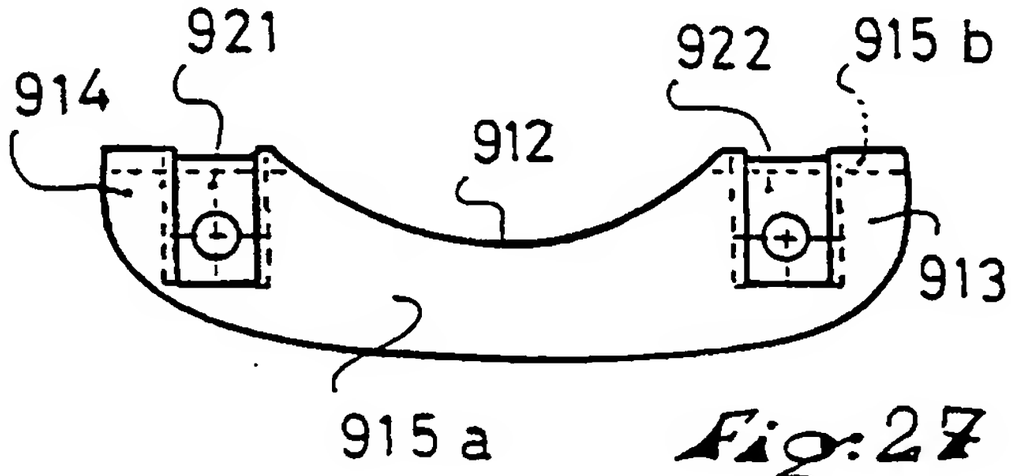


Fig:27

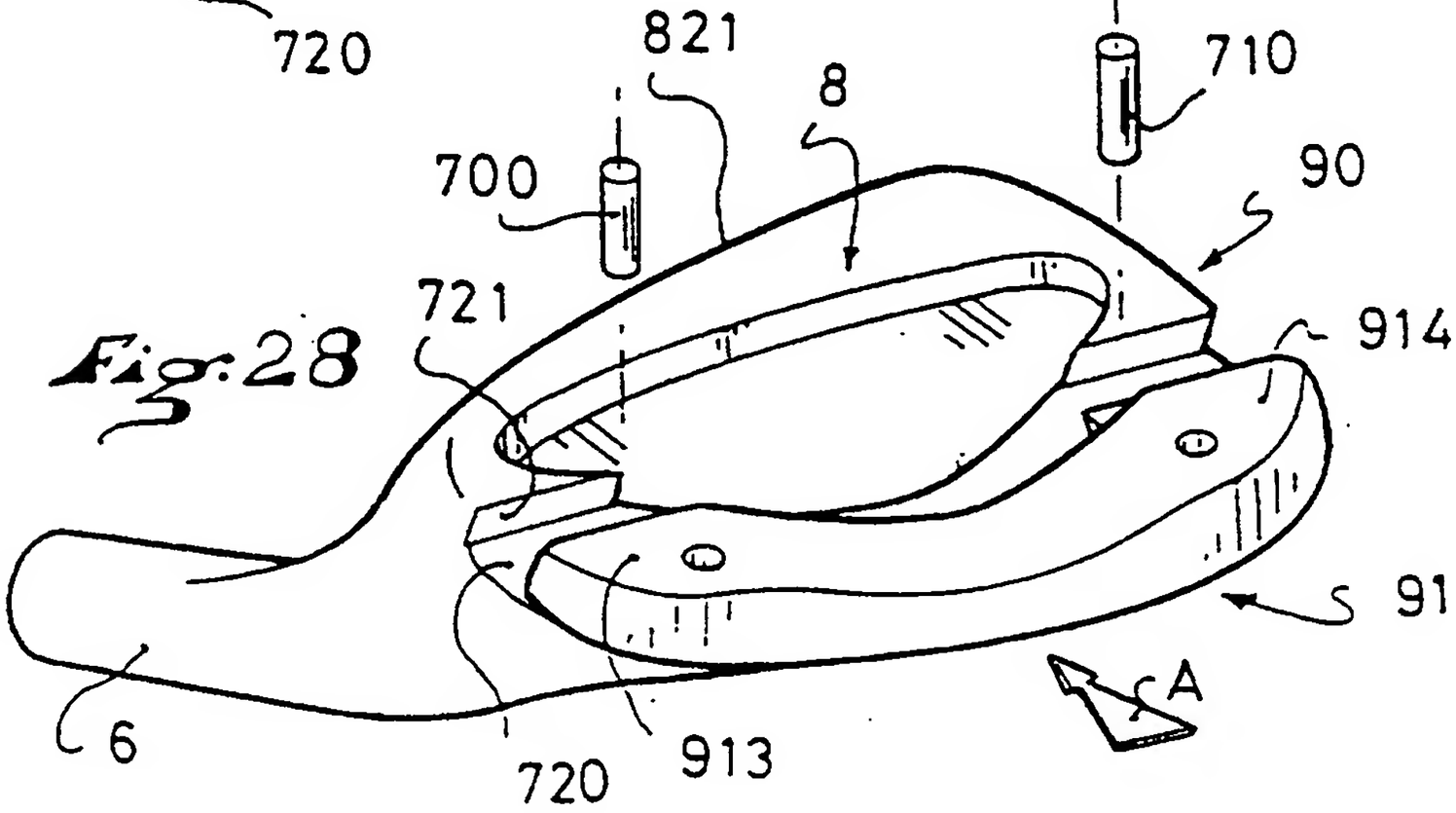


Fig:28

Fig: 29

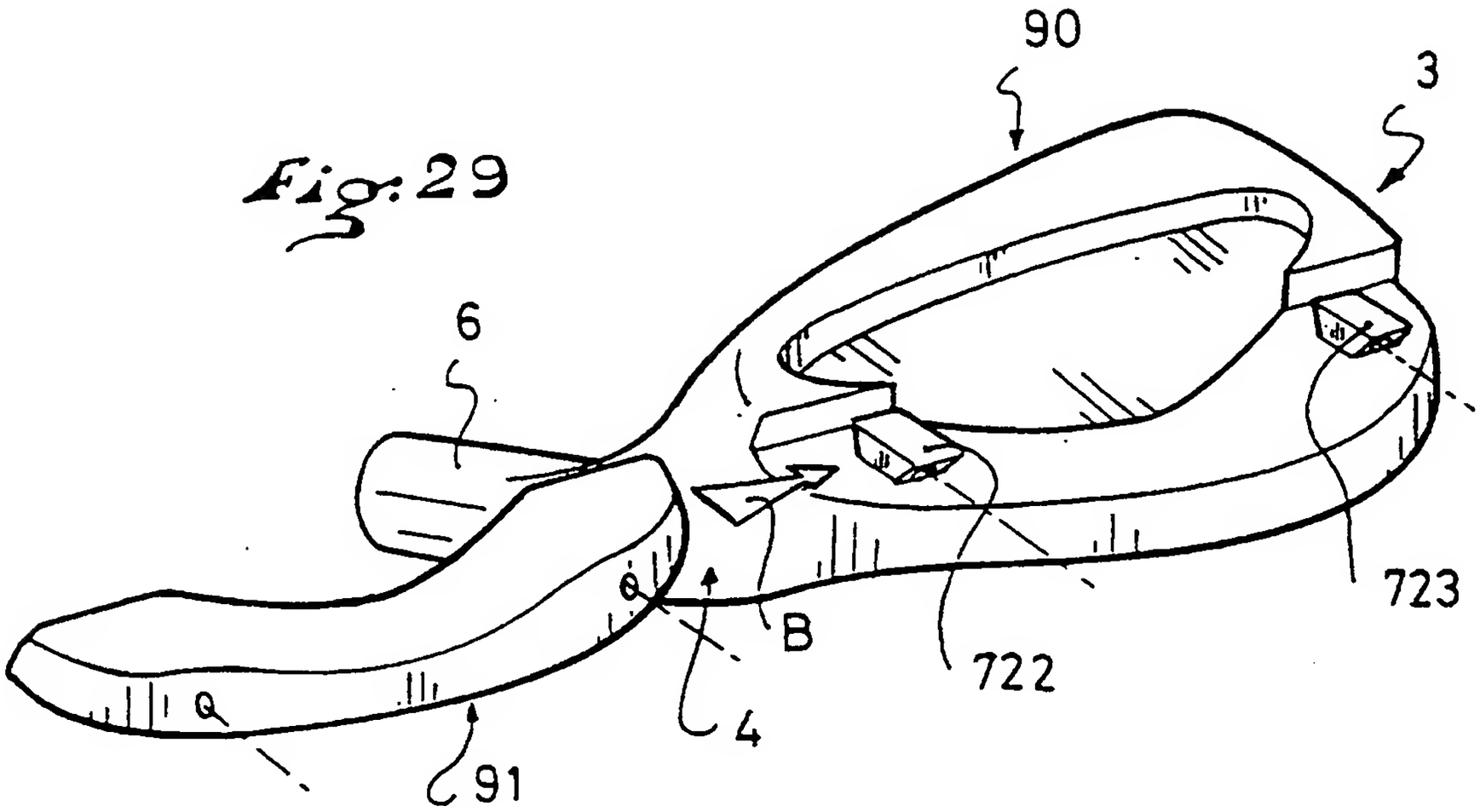


Fig: 30

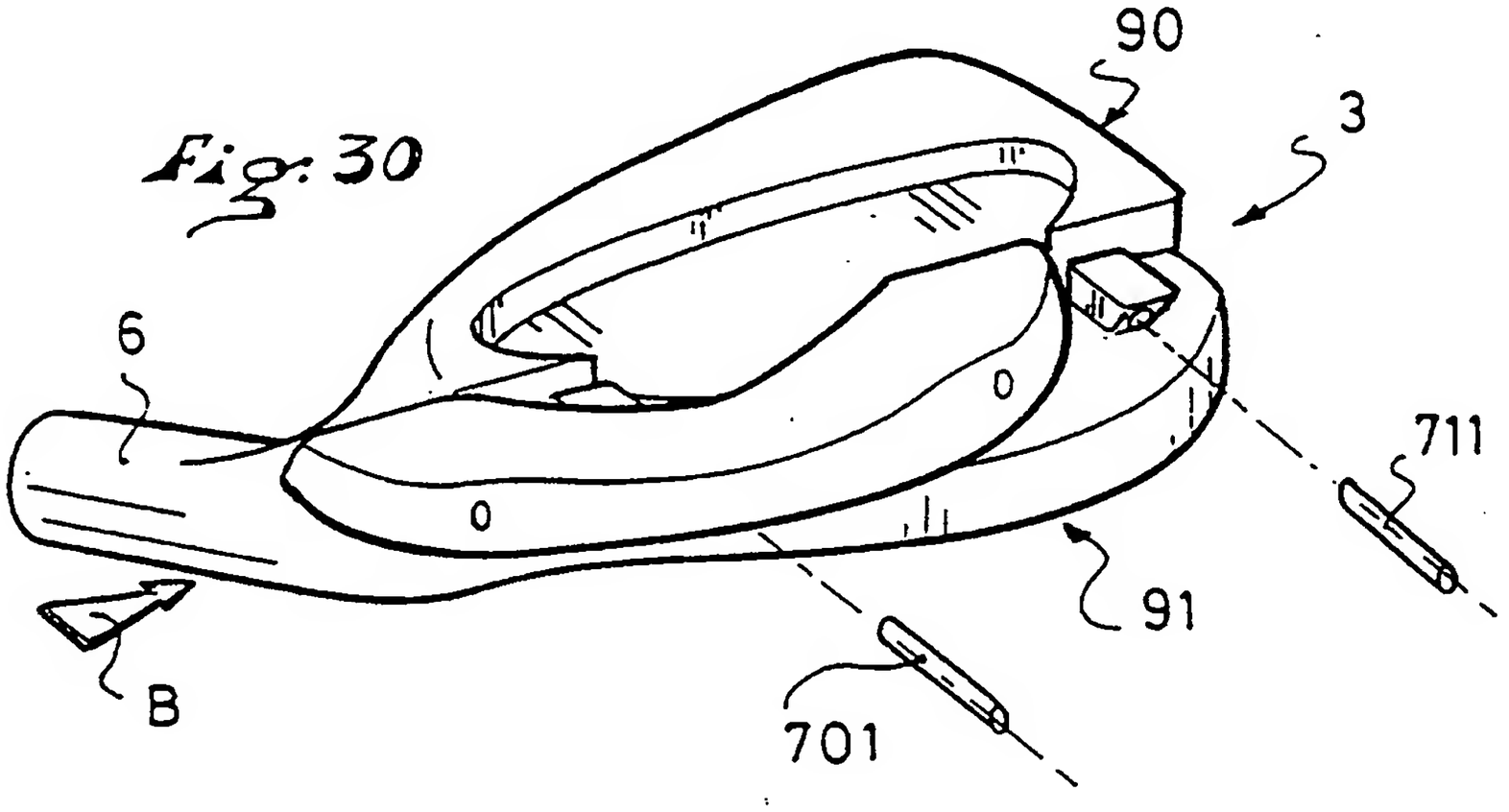
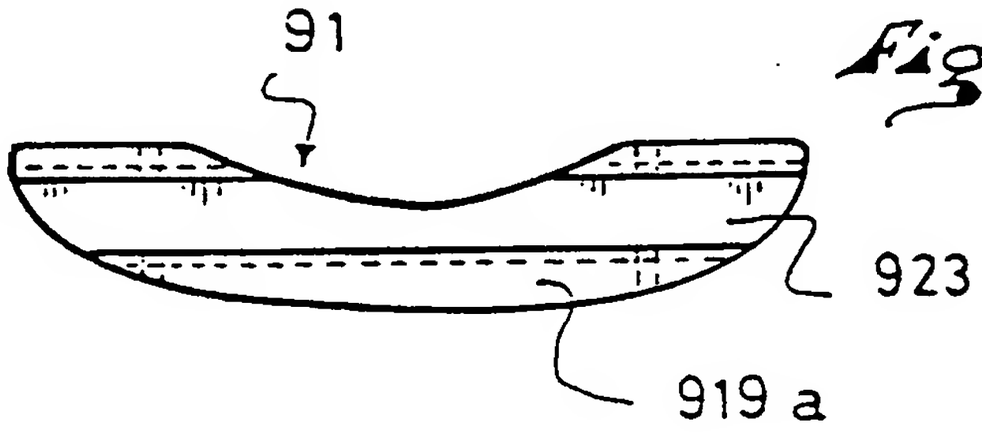


Fig: 31



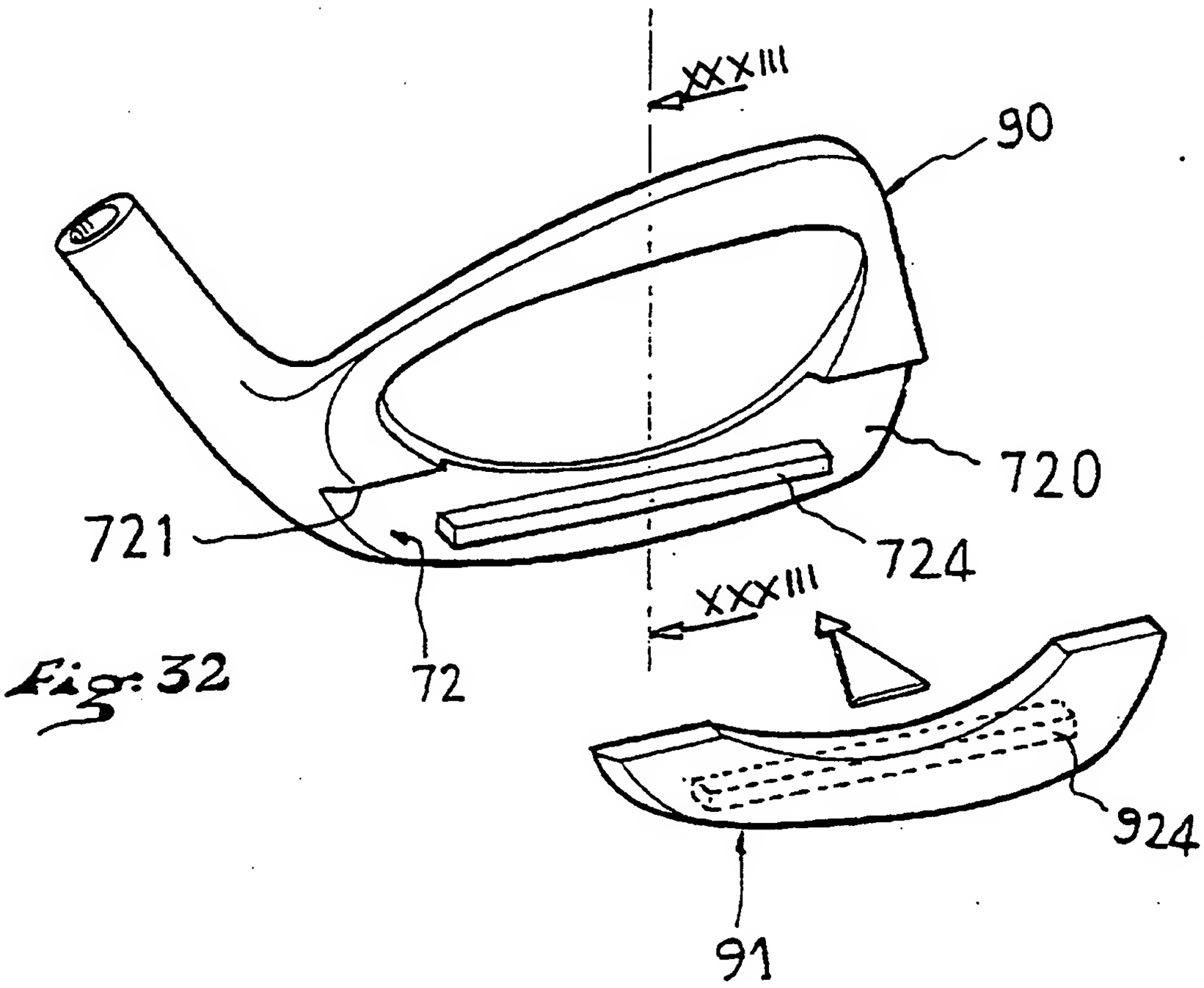


Fig: 32

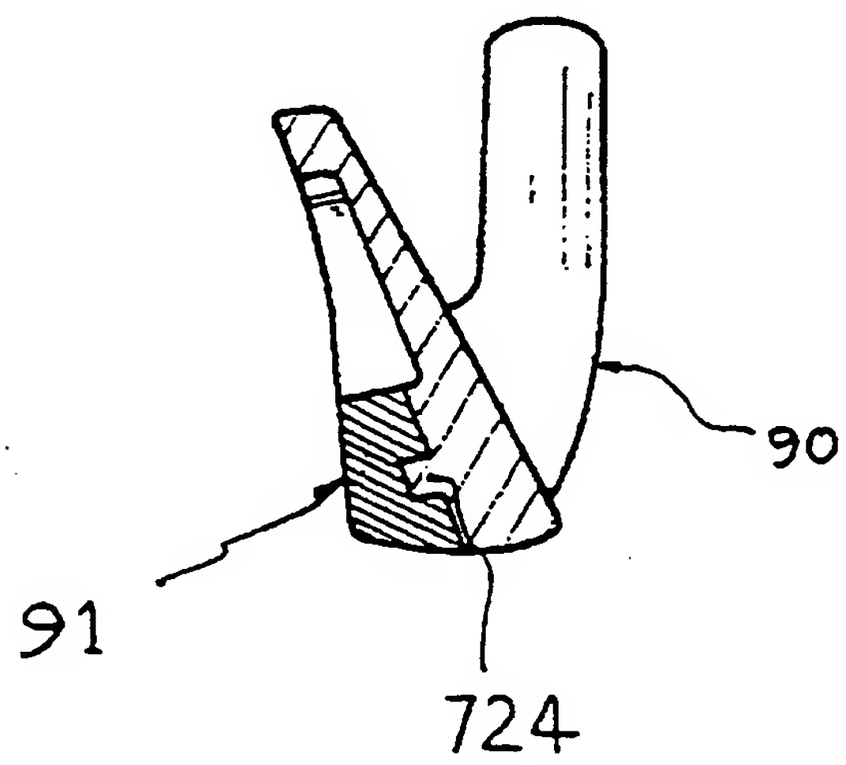


Fig: 33

IRON GOLF CLUB HEAD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of golf, and is related in particular to an iron golf club head.

2. Description of Background and Related Art

Different categories of iron golf clubs are commercially available. Among them, the clubs having a head shaped like a metallic blade are commonly referred to as "blade". These clubs are mainly intended for experienced players and professional players who appreciate the quality of the sensation at impact, in spite of the blade's lack of tolerance during an off-centered stroke. None of these heads achieve high values of inertia "Iy" (those measured around the vertical axis passing through the center of gravity). In particular, the measured values for a 5 iron are very close to or less than 220 $Kg.mm^2$. Such low values lead to a lack of tolerance that may distance and accuracy degradation and in particular a deviation of the ball with respect to the aimed trajectory when the impact occurs in a zone that is

laterally offset in relation to the center of the striking face.

There is another category of widely used clubs whose heads are generally made of steel, and which have a rear cavity allowing for a peripheral distribution of the mass around the useful portion of the striking surface that is generally referred to as the sweet spot. These clubs are known as cavity back irons. Most players at any level play with this category of clubs due to versatility and tolerance to off-centered strokes. In view of the peripheral distribution of the mass, the values of inertia (Iy) are greater than those of the blade-type heads, and are on the order of 220-240 $Kg.mm^2$ for a 5 iron. However, generally in this category, the position of the center of gravity is high with respect to the ball and generally above the theoretical point of impact, which causes a harsh sensation upon impact that is not appreciated by the player. In particular, the vertical height of the center of gravity with respect to the ground varies between approximately 0.75 and 0.85 inches.

Finally, there are various other types of irons, such as clubs whose heads are made out of non-ferrous metallic materials such as titanium. Those that are commercially available reach substantial values of inertia (Iy), on the order of 240-250 $Kg.mm^2$ for a 5 iron, in view of titanium's low density which allows for an enlargement of the head with a total mass equivalent to that of a steel head. However, the center of gravity for these clubs is very high, around 0.9 inch, which may give them a poor sensation and a low rate of backspin, resulting in a loss of control.

Other heads have a two-part structure made of metals with different densities. Generally, that structure is based on a striking face made of a lightweight material such as

aluminum or titanium, and a body portion made of a heavy material such as steel, for example. Therefore, substantial values of inertia (Iy) have been measured between 270 and 330 $Kg.mm^2$ due to the fact that mass located in the zone of impact has been distributed at the periphery of the club head. The performance of this type of clubs also suffers if the center of gravity is not properly positioned both vertically, with the known negative influence on the sensation upon impact and the backspin rate, and horizontally, which leads to a tendency to a slice deviation of the ball due to the gear effect caused on the ball.

U.S. Patent No. 5,429,353 relates to a set of cavity back iron clubs whose perimeter portion surrounding the cavity has a depth that varies with respect to the end of the cavity whose surface is planar and parallel to the surface, such that the position of the center of gravity coincides with the geometrical center of each head. It is considered that the geometrical center is the point located substantially at a distance that is equal to the radius of a golf ball measured from the center point along the sole. This corresponds to a distance of approximately 0.8-0.9 inch (about 2.0-2.3 cm) of the center point of the sole.

U.S. Patent No. 5,094,457 relates to a golf club whose rotational inertia about the axis of the shaft is lowered by displacing the center of gravity in the direction of the axis of the shaft, and by bringing it closer to the sole of the head, the goal being to facilitate the rapid rotation about the axis of the shaft "Is" before the impact in order to render the face of impact perpendicular to the plane of the swing. If one considers the formula $Is = Iy + md^2$ (d being the distance of the center of gravity with respect to the

axis of the shaft), the solution of the prior art consists of minimizing Is by reducing, among others, the preponderant factor, namely d, that evolves to the square. The center of gravity is thus brought too close to the axis of the shaft, at approximately 1.35 inch (or 34.29 cm) from the axis of the shaft. Thus, the center of gravity is offset toward the heel with respect to the center of impact. As a result, there is a decrease in the performance, i.e., in the restitution or initial speed of the ball when stricken at the center of impact.

Furthermore, the U.S. Patent No 5,094,457 is silent regarding the necessity of maximizing the inertia around the vertical axis passing through the center of gravity. Besides, it is likely that by seeking to reduce Is as much as possible, substantial values of Iy cannot be achieved.

As shown in FIGS. 9B, 10A-10C of this prior art document, the iron head is of the blade-type, i.e., it does not have any rear cavity making it possible to obtain a satisfactory inertia about the axis Iy. More specifically, the head has a blade-shaped upper portion with a substantially constant thickness that is connected to a thick lower portion where the mass is concentrated.

Such a construction has the same general disadvantages as those reported for the blade-type irons.

SUMMARY OF THE INVENTION

In view of this state of the art and the noted disadvantages, the present invention has an enlarged club head, to optimize the distribution of mass on a iron head,

more particularly by adjusting the position of the center of gravity so as to avoid the drawbacks of the prior art, while maintaining a moment of inertia around Iy that is sufficient to stabilize the club upon impact, even in the case of an off-centered stroke.

The invention may also result in a significant increase because the center of gravity is located beneath the geometrical center of the face.

To this end, the invention concerns an iron golf club head including a heel area, a toe area, a striking surface extending between the toe area and the heel area, a sole that rests on a ground plane when the head is placed at address, and a rear surface; the rear surface being provided with a cavity that is open rearwardly and surrounded by a peripheral edge. The preferred club has a heel area having an opening for axis I-I' located in the heel area for the introduction of a shaft. The head has preferably a center of gravity located beneath a horizontal plane whose height with respect to the sole plane is on the order of 18.3 mm (about 0.72 inch). Furthermore, the preferred club head also has an inertia around the vertical axis passing through the center of gravity of the upper body greater than or equal to 230 $kg.mm^2$. In a preferred construction, the club head includes a body made of titanium or of titanium alloy, and at least one additional mass with a greater density than the density of the body and the peripheral edge includes a lower portion extending beneath the cavity, and from the heel area to the toe area; the additional mass(es) being at least a part of the lower portion.

The choice of a body made of a material such as titanium or titanium alloy having a low density and precisely localized additional masses having a higher density, makes it possible to adjust the fundamental parameters, i.e., the position of the center of gravity and the inertia to avoid the disadvantages of the prior art.

According to another characteristic of the invention, the center of gravity is located at a distance from the axis I-I', that is between 35 mm and 40 mm. In this way, the center of gravity is not too far from the heel, which could otherwise lead to a reduction of the initial speed of the ball. One also avoids having too great of an offset of the center of gravity at the toe so as to avoid a tendency of the ball to deviate to the right, as a result of the gear effect.

According to another characteristic of the invention, the additional mass represents 25 - 70% of the total mass of the head, the remainder being represented by the body made of titanium or titanium alloy. As a result, the additional mass represents a significant portion of the mass to be distributed in the head, which makes it possible to achieve the required characteristics of inertia and of the center of gravity.

BRIEF DESCRIPTION OF THE DRAWINGS

Other characteristics and advantages of the invention will be better understood by means of the description that follows, with reference to the annexed drawings illustrating, by way of non-limiting examples, how the invention is embodied, and in which:

FIG. 1 is a front view of the head according to the invention;

FIG. 2 is a rear view of the head of FIG. 1;

FIG. 3 is a side view of the toe of the head of FIG. 1;

FIG. 4 is a cross sectional view along the line IV-IV of FIG. 2;

FIG. 5 is a cross sectional view along the line V-V of FIG. 2;

FIG. 6 is a cross sectional view along the line VI-VI of FIG. 2;

FIG. 7 is a rear view of the head according to a variation of the invention.

FIG. 7a is a cross sectional view along the line VII-VII of FIG. 7;

FIG. 8 is a view similar to FIG. 7 according to another variation;

FIG. 8a is a cross sectional view along the line VIII-VIII of FIG. 8;

FIG. 9 is a view similar to FIG. 7 according to yet another variation;

FIG. 10 is a rear view of a head according to a preferred embodiment of the invention;

FIG. 11 is a perspective rear view of the head of FIG. 10;

FIG. 12 is a cross-sectional view of FIG. 10 along the line XII-XII;

FIG. 13 is a cross-sectional view of FIG. 10 along the line XIII-XIII;

FIG. 13a is a detailed view of FIG. 13;

FIG. 14 is a cross-sectional view of FIG. 10 along the line XIV-XIV;

FIG. 15 is an external bottom view of the additional mass of the head of FIG. 10;

FIG. 16 is an internal view of the additional mass of the head of FIG. 10;

FIG. 17 is a perspective bottom view of the additional mass of the head of FIG. 10;

FIG. 18 is a perspective exploded view showing the particular assembly of a head according to a particular embodiment of the invention;

FIG. 19 is a rear view of FIG. 18;